RUCH FILOZOFICZNY

TOM LVIII – NUMER 2 – ROK 2001
PL ISSN 0035–9599

Riccardo M. Campa

Fleck's place in the philosophical debate

(Polskie Towarzystwo Filozoficzne, Oddział w Toruniu, 7 XII 2000 r.)

1. Ambiguities

Fleck's ideas did not have an immediate and appreciable impact on the philosophical debate. As is well known, his 1935 masterpiece *Genesis and Development of a Scientific Fact*[1] has been rediscovered in the 1960s by Thomas Kuhn. One consequence of this temporary marginalization has been the ambiguous (non uniform) reception of his ideas. This is nothing surprising, since rarely the interpretation produced by commentators coincide. However, Fleck became famous only *post mortem* and, consequently, he did not have the possibility to clarify his position concerning some important epistemological problems.

The effort I will produce in order to collocate Fleck's ideas in the correct cognitive space is not merely to satisfy idle curiosity. The debate in the *philosophy and sociology of science* (hereafter – PSS) has probably never been so harsh as in this end of millenium. In recent centuries, single scholars and/or entire schools of thought have engaged in various disputes over different (sometimes conflicting, sometimes mutually enriching) *images of science*. More recently the situation has significantly changed: in the present–day debate, not only a particular image of science is put in question, but *science itself*, as institution and as a specific type of knowledge is challenged[2]. And the reaction to this radical attack in not less radical[3].

In the past the main aim of the PSS was establishing, rationally and empirically, the boundaries between science and other forms of knowledge. This distinc-

---

[1] L. Fleck, *Genesis and Development of a Scientific Fact*, Chicago University Press, Chicago 1979.

[2] See, for instance: P. K. Feyerabend, *Against Method. Outline of An Anarchist Theory of Knowledge*, Verso, London 1978; T. J. Pinch and H. M. Collins, *Is Anti–Science Non–Science?*, in "Sociology of the Sciences Yearbook", Vol. 3: 221–250; and T. J. Pinch and H. M. Collins, *Private Science and Public Knowledge: The Committee for the Scientific Investigation of the Claims of the Paranormal and Its Use of the Literature*, in "Social Studies of Science" 14, 1984: 521–546.

[3] Among the most resolute defenders of Science and Reason (with capital letters) there is Mario Bunge. Cf. M. Bunge, *In Praise of Intolerance to Charlatanism in Academia*, in "The Flight from Science and Reason", Annals of the New York Academy of Sciences, Vol. 775, June 1996.

tion has, in principle, also had to be functional for the detection and refutation of pseudo–science, that is, of non–scientific knowledge presented under the denomination of "science" in order to get social and academic credits. Today pseudo–science seems to be a minor problem. Science has gained such a bad name that it is sometimes easier to obtain credits by presenting ideas explicitly devoid of any connection with laboratories, experiments, mathematics, and rigorous reasoning. Now the main distinction in the market of ideas seems to be that between *science* and *antiscience*, or more precisely between pro–science PSS and anti–science PSS.

To understand why Fleck represents a peculiar case–study in this panorama, it is enough noticing that: a) his work has been edited, promoted, and defended by Robert Merton[4]; b) many "militants" of the pro–science and anti–science parties name themselves, respectively, Mertonians and post–Mertonians; c) the post–Mertonians (also self–identified as constructivists and relativists) consider Fleck as one of their main masters. In sum, Merton is taken as the godfather of the pro–science party and Fleck as the godfather of the anti–science one, *but* Fleck's thought has been promoted by Merton! This seemingly rebus shows that a correct interpretation and evaluation of Fleck's ideas is still far to come.

My main thesis is that *Fleck occupies an intermediate (though precise) cognitive space between Merton and the new radical schools in the PSS.* Surely Fleck's approach can be seen in many respects as an anticipation of the relativist/constructivist program coming to the fore in the 1980s, but there are also points of convergence with Merton's view which deserve to be adequately emphasized. As well, there are non–negligible differences between Fleck and his more radical followers which need to be underlined.

2. Triadic vs. Dual Sociological Epistemology

The following table is a schematized representation of my reading of the twentieth century epistemological debate.

At the beginning of the century the epistemological approach which dominates the debate about the foundation of science is rooted in the empiricist tradition of Bacon, Mill and Comte. This approach, often labeled "positivistic" undervalues or totally ignore the role and the characteristics of the knowing subject in science. By ignoring the knowing subject, positivists neglect the role of genius as well as the role of extra–cognitive factors (e. g. the influence of the social milieu) in scientific research. Carnap's *Aufbau*[5] is the last serious and systematic attempt to reconstruct human knowledge only by mean of *data and logic*. As is well known, the failure of

[4] Together with Thaddeus Trenn.

[5] R. Carnap, *The Logical Structure of the World*, University of California Press, Berkeley and Los Angeles 1967.

this attempt has been recognized by Carnap himself[6]. Black arrows in the table are to indicate the first breakthrough in the history of epistemology: from *dual epistemology* to *triadic epistemology*.

	Type of Metascience	Scholars
1	Object–to–be–known → resulting knowledge	Bacon, Mill, Comte (preceding centuries) Carnap (1920s)
	⬇ ⬇ ⬇	
2	Object–to–be–known → rational knowing subject → resulting knowledge	Popper (1930s) Meyerson (1930s) Koertge (1970s)
3	Object–to–be–known → rational/social knowing subject → resulting knowledge	Merton (1930s) Bunge, Lakatos (1960s)
4	Object–to–be–known → social knowing subject → resulting knowledge	Fleck (1930s) Kuhn (1960s)
	⇩ ⇩ ⇩	
5	Social knowing subject → resulting knowledge	Feyerabend (1970s) Bloor, Collins, Knorr, Latour, Woolgar (1980s)

Triadic epistemology introduces the knowing subject as a non–negligible factor that mediates between object–to–be–known and resulting knowledge. It is however necessary to qualify more precisely the different types of triadic epistemology, by distinguishing between *rational*, *social/rational*, and purely *social* knowing subject. Popper's *logic of discovery*[7] is alternative to dual (traditional) epistemology because it recognizes the role of the knowing subject in the form of *genius in science*. Only geniuses like Galileo, Newton, Einstein, Darwin could formulate bold conjectures able to revolutionize science. A set of methodological rules will never produce good science alone. Popper's knowing subject uses imagination, but he/she is still assumed to be a purely rational one. When social factors interfere, it follows that the resulting knowledge is not "genuine". Since the 1960s, Popper's metascience has been defended and developed in different directions by numberless philosophers[8].

---

[6] The recognition of the failure is the demonstration that positivists are sometimes less dogmatic than their enemies.

[7] K. R. Popper, *The Logic of Scientific Discovery*, Hutchinson, London 1959.

[8] Among Popperians it is worth mentioning: Noretta Koerge (in America), Adam Grobler (in Poland), Dario Antiseri, Angelo Petroni, Marcello Pera (in Italy), Hans Albert (in Germany), William Bartley III (Great Britain).

Already since the 1930s we encounter another version of triadic epistemology: that underlying Merton's sociology of science. Merton assumes that the knowing subject is fundamentally rational, but he is also aware that social factors play a significant role in the formation of scientific knowledge (true knowledge included). Since the 1960s, triadic sociological–and–rational epistemology have been independently developed by professional philosophers of science like Bunge[9] and Lakatos[10]. The difference between these two scholars is that Bunge is conscious of the convergence between his studies in the philosophy of science and Merton's studies in the sociology of science, while Lakatos considers Merton closer to Kuhn and Polanyi.

Indeed, there is a third type of triadic epistemology which tends to underestimate the role of reason in scientific research and focuses almost exclusively on the social/historical character of the knowing subject. Again, this perspective emerges in the 1930s, but conquers a major popularity in the 1960s. Fleck's 1935 *Genesis of Development of a Scientific Fact* is the point of arrival of a long tradition of thought in Poland, going back to Kramsztyk and the "Polish philosophico–medical school"[11]. Kuhn's 1962 *The Structure of Scientific Revolutions*[12], directly inspired by Fleck's work, is now seen as the manifesto of this type of theory of knowledge.

Yet, triadic epistemology (in its three versions) is not the last stage of transformation of the theory of knowledge. White arrows are to indicate a second important breakthrough in the history of metascience. Since the 1970s, and more radically in the 1980s, a fifth form of metascience has emerged. It is again a dual epistemology. However, contrarily to positivistic metascience, the resulting knowledge is assumed to be produced entirely by the social knowing subject, and not by the object–to–be–known. Between the first and the fifth type of metascience there are, nonetheless, points of convergence. For instance, both epistemologies neglect the role of genius. The first philosopher of science who tended to neglect the role of objective reality in the creation of knowledge was Feyerabend. Afterwards his position has been more and more radicalized by the post–Mertonians sociologists of scientific knowledge. Latour and Woolgar's *Laboratory Life*[13] and David Bloor's

---

[9] See M. Bunge, *Social Science Under Debate: A Philosophical Perspective*, University of Toronto Press, Toronto 1998; and M. Bunge, *A Critical Examination of the New Sociology of Science*, in "Philosophy of the Social Sciences", Vol. 21 No. 4, December 1991, and Vol. 22 No. 1, March 1992.

[10] See I. Lakatos, *The Methodology of Scientific Research Programmes*, Cambridge University Press, Cambridge 1978.

[11] Cf. I. Löwy, *From Z. Kramsztyk to L. Fleck: Medical Observations and the Construction of Clinical Facts*, in "The Polish Sociological Bulletin", No. 1, 1989: 39–48.

[12] T. Kuhn, *The Structure of Scientific Revolutions*, The University of Chicago Press, Chicago 1962.

[13] B. Latour and S. Woolgar, *Laboratory Life: The Social Construction of Scientific Facts*, Sage, Beverly Hills 1979.

Knowledge and Social Imagery[14] are usually taken as exemplars of this trend. This last form of theory of knowledge, very often, characterizes itself as "antiscientific". Indeed, these scholars intend to revalue alternative forms of knowledge and practices like: magic, miracles, witchcraft, astrology, telekinesis and paranormal phenomena in general. Brief, everything banned by modern science as superstition.

4. Fleck and Merton

Differences. According to Merton the success of science in explaining objective reality is evident. The interplay of human reason, sophisticated techniques of research, particular social and cultural structures, genius of some individuals, chance, and other factors has contributed to make of science one of the most successful human enterprises. Merton maintains that "[s]peaking of the progress of science in this concrete historical sense means only that the contemporary physical and life sciences can account with more widespread coherence, precision, and often predictability for all the natural phenomena which the ancients tried to account for, and much else besides, including an indefinitely wide range of natural phenomena which were not even detectable"[15].

Fleck seems instead to be much more skeptical concerning the progress of science: "I do not think that today's science is closer to the objective picture of the world than the science of 100 years ago. On the other hand, I am sure that today's science is closer to our world of today, while the science of 100 years ago was closer to what was then the world of the creators of science... to our grandsons, the science of 1940 will not seem much better than that of 1840"[16].

Similarities. This profound difference notwithstanding, Merton and Fleck can be assimilated for the fact that both subscribe to a triadic sociological epistemology[17]. Evidence that Fleck believes in the existence of an objective reality, external and independent from the human and social world are not absent, as the following paragraph demonstrates.

---

[14] D. Bloor, *Knowledge and Social Imagery*, Routledge and & Kegan Paul, London 1976.

[15] This Merton's quotation is found in P. Sztompka, *Robert K. Merton*: An Intellectual *Profile,* MacMillan, Hong Kong 1986: 274. Sztompka's reference is to Merton, *Progress in Science? A Shapeless Cloud of a Question*, lecture delivered in 1982 at Temple University Colloquium in Philadelphia (mimeographed) pp. 1–20. The main works written by Merton are: *Social Theory and Social Structure*, The Free Press, New York 1968; *The Sociology of Science: Theoretical and Empirical Investigations*, The University of Chicago Press, Chicago 1973; *Sociological Ambivalence and Other Essays*, The Free Press, New York 1976; *Science, Technology and Society in Seventeenth Century England*, Harper & Row, New York 1970.

[16] L. Fleck, *Problems in the Science of Science*, in Cohen and Schnelle (eds.), *Cognition and Fact*, Reidel, Dordrecht 1986: 116–117.

[17] This seems to be also Sztompka's opinion. See P. Sztompka, *Robert K. Merton...*, op. cit.: 76–77.

"The origin of the number 16 for the atomic weight of oxygen is almost consciously conventional and arbitrary. But if 16 is assumed as the atomic weight for O, oxygen, of necessity the atomic weight of H, hydrogen, will inevitably be 1. 008. This means that the ratio of the two weights is a passive element of knowledge"[18].

The existence of passive elements of knowledge is an "axiom" for those philosophers who qualify themselves as rationalist and realist, but not every philosophers are ready to accept postulates like the *existence* of an external world and the *independence* of this world from human linguistic manipulations.

3. Fleck and the Relativist/Constructivist Program

Differences. There is a large number of scholars and schools that self–identify as relativists or constructivists. These approaches sometimes differ significantly and thus should be adequately distinguished. The most radical school is probably that of Collins, Travis, and Pinch (authors that we can symbolize with the brief locution 'Bath group,' since their ideas developed at Bath University, in the United Kingdom). Besides the Bath group one encounters the Edinburgh group, including figures like David Bloor, Barry Barnes, Steven Shapin, Donald MacKenzie, Bill Harvey, and Andy Pickering, and insisting that science is socially determined and that all scientific programs and results can be explained (in part or at all) as the result of social 'interests'. Then, there is also the constructivist program followed by Krohn, Whitley, and Knorr–Cetina, which does not consider relativism as a necessary assumption[19] and assumes that science is practical, local, and constructed (and not theoretical, universal, and 'discovered' as it is traditionally postulated). Finally, there is on the scene also the group adopting "discourse analysis" methodology and mainly represented by Mulkay, Gilbert, and Woolgar.

Here, considering the parameters of my paper, I will simply label all these schools and scholars as "the relativist/constructivist program"(hereafter – RCP). I am however aware that not all of them would accept to be put in the same category[20].

The mentioned scholars variously and ambiguously oscillate between dual sociological epistemology (social knowing subject → resulting knowledge) and triadic sociological epistemology (object–to–be–known → social knowing subject

---

[18] L. Fleck, *Genesis...*, op. cit.: 83.

[19] K. D. Knorr–Cetina, *The Constructivist Programme in the Sociology of Science: Retreat or Advance?* in "Social Studies of Science", London and Beverly Hills, Vol. 12, 1982: 321.

[20] As Mulkay and Gilbert opportunely underline, "there is a tendency to oversimplify intellectual boundaries in the course of lively academic debate. No doubt [Gieryn] ...is right in suggesting that commentators have previously often used the term 'Mertonian' rather carelessly in devising a background within which the originality of their own work can become evident. It seems likely that we all characterize intellectual movements to which we do not belong in ways which seem bizarre to those named insiders" – M. Mulkay and G. N. Gilbert, *What is the Ultimate Question? Some Remarks in Defence of the Analysis of Scientific Discourse*, in "Social Studies of Science", London and Beverly Hills, Vol. 12, 1982: 309.

→ resulting knowledge). Here I will stress more on the radical angle of the RCP. Gieryn lists a series of sentences by Collins which make think the relativist position as "a step back to 'sociological reductionism', an exemplary case of the fallacy of 'nothing but–ism'"[21]. And these sentences seem not to leave many doubts about the radicality of Collins' position: "the natural world has a small or non–existent role in the construction of scientific knowledge"; "to press the account forward requires that it be taken that the phenomenon itself does not dictate the outcome of the argument"; "[We are] refusing to put any demands at all upon reality, to circumscribe possible individual beliefs"; "nothing outside of courses of linguistics, conceptual and social behavior can affect the outcome of these arguments"[22].

To be sure, Collins seems to assume that an external world does exists (or could exist), but humans are considered unable to grasp any knowledge about it. Zybertowicz takes even a more radical position. He argues that: a) "the scientific cognition could not evolve as a legitimate form of activity, unless it has become socially recognized that there is something out there to be searched for..."; b) "there are symbolic manipulations that can actually perform expected changes in the physical properties of various objects"[23]. If I interpret correctly these sentences, Zybertowicz is ready to exclude that outside the social world there is an independent natural world. This exclusion provides an epistemological legitimation for magic, miracles, telekinesis, telepathy, and other paranormal phenomena. Words are not only to represent things, they are also to change things, for the mental (and so conceptual, linguistic) world is not sharply disconnected from the natural world.

I think that Fleck differs from Collins because, as we have seen, he assumes that there are passive elements in our knowledge and, moreover, he assumes that we can more or less precisely understand *where* nature intrudes in science. The knowing subject establishes conventionally the atomic weight of oxygen; an external and independent natural world establishes the ratio of the weights of oxygen and hydrogen. Then, he differs from Zybertowicz because he never explicitly says that magic, astrology, alchemy are (or could be) "true knowledge". He just says that these forms of non–scientific knowledge are to be understood in relation to a particular thought–style, which is located in a specific historical time and social space. Often these non–scientific assumptions constitute a source of error, but sometimes they help science to develop and, consequently, they cannot be derided or taken only as a shame of the human kind.

---

[21] T. F. Gieryn, *Relativist/Constructivist Programmes in the Sociology of Science: Redundance and Retreat*, in "Social Studies of Science", London and Beverly Hills, Vol. 12, 1982: 287.

[22] Ibid.

[23] A. Zybertowicz, *Theory of Culture, Stages of Social Cognitive Change and the Paranormal Phenomena*, in „Studia Metodologiczne", z. 9, 1999: 35–70.

"...Poignant jokes against Pasteur circulated. Liebig, blinded by his preconceived ideas, was unable to perceive some easily demonstrable and quite distinct phenomena supporting Pasteur's claim.

It would, however, be a mistake to assume that the style of thinking, and the leading general ideas or images (*Gestalten*) derived from this style, are always rather a hindrance in the search for truth and a source of error. The whole of modern knowledge of infection and infectious diseases originates in very ancient beliefs in analogy between putrefaction and disease, and in small 'animalcules' as a cause of both...

All these 'ingenuous intuitions' which existed before any empirical proof, and stemmed from an old pre–scientific *Denkstil*, acted throughout the ages as a propelling force for a host of discoveries. It is doubtful whether our knowledge of infectious disease would have made such progress without these 'intuitions'".

As we can see, Fleck still uses categories like "truth," "error," "discoveries," "progress" which are banned in the vocabulary of postmodernists. He never says that truth and illusion are indistinguishable[24] and, moreover, he often qualifies scientific knowledge as "true knowledge". What he refuses is the qualification of other forms of knowledge as ridiculous superstitions or meaningless ideas.

There is, then, another important difference between Fleck and present constructivists: Fleck was a microbiologist turned sociologist. This is to say that he was (in principle) competent to perform a sociological analysis of microbiology. Latour and Woolgar are instead anthropologists *tout court*, claiming that their ignorance of natural science is a point of strength and not of weakness of their studies. They comment on the *content* of biological theories, without having any basic knowledge of biology and chemistry. They are in that situation defined by Bunge as *willful or postmodern ignorance*[25]. I think that sociologists of science can focus indifferently on the social structure of the *scientific community* (as Merton mainly does) or on the *very content* of science (as Fleck mainly does). *But* by being a pure sociologist, one can perform only the first type of study. In the second case a further specialization is needed. A sociologist of bacteriology must be a sociologist *and* a bacteriologist. An anthropologist of neurobiology must be an anthropologist *and* a neurobiologist, and so on. Otherwise the sociology of science will be only a caricature of a science.

Similarities. There are many similarities between Fleck's approach and the RCP. The most striking one is the negation of the role of genius in science. Indivi-

---

[24] Cf. Fleck, *Problems of the Science of Science*, in Cohen and Schnelle (eds.), *Cognition...*, op. cit.: 123.

[25] "[W]illful or postmodern ignorance is the deliberate refusal to learn items relevant to one's interests. Example: the refusal of the psychotherapist and the philosopher of mind to learn some experimental psychology and neuropsychology; the refusal of the literary critic with some sociological interests to learn some sociology; and the refusal of the philosopher of science to learn a bit of the science he pontificates about. All these are instances of willful ignorance. This is the only intolerable kind of ignorance, for it is a form of dishonesty" – M. Bunge, *In Praise of Intolerance...*, op. cit.: 108.

dual's cognitive capability almost disappears in Fleck's metascience as well as in relativist/constructivist PSS. The thought–style not only *influences* the outcome of scientific inquiry, it fully *determines* the very content of observation[26].

5. Taking Position

As we have seen, I assume that Fleck (together with Kuhn) represents one of five different modes to interpret the problem of scientific cognition. In this final remark I intend to take position in the controversy. I personally support the third epistemological approach presented in this paper, namely that proposed by Merton, Bunge, and Lakatos, among others. In other words, I believe that: a) there exists *true* and *false* knowledge (or, more precisely, that there is knowledge which has a greater *content of truth* than other); b) scientific knowledge contains active elements (hypothesis, conjectures) as well as passive elements (facts); c) it is worth distinguishing between *constructs* (concepts, models, theories, etc.) and *facts*: science is a linguistic construction; objective reality is not; d) a certain type of *scientific reason* (historically emerged) plays a fundamental role in the creation/discovery of true knowledge; d) *social factors* play a role in the creation/discovery of true as well as false knowledge; e) social structures *influence*, but not fully *determine* the individual knowing subject; f) *genius* plays a role in the formulation of conjectures, hypotheses, models, theories, concepts, and the ways of testing them; g) scientific constructs are in principle *universal* and only contingently *relative*; h) there is *progress* in science; i) frequency, range, and precision of *predictions*, *logical consistence* between different scientific discoveries, and *technological applications* are indices of scientific progress; l) all these assumptions as well as their negation have a (partial) *metaphysical content*, that is, a non demonstrable core.

On these assumptions I found my criticism of Fleck's metascientific creed. He asserts that 1940 science is not closer to objective reality than 1840 science. However, his negation of progress is based on a peculiar way of reasoning. He assumes that, since science will change again in future, to his grandsons 1940 science will not appear much better than that produced one century before. A mathematical metaphor could represent well this perspective. In a progressive sequence of numbers, number 5 is "bigger" than number 4. Nonetheless, observers can clearly perceive the difference only by being located "near" the mentioned numbers (say, in 0, or in 4, or in 5, etc.). If the observer locates him/herself near ∞ (infinite), the difference between 4 and 5 will just disappear. Whatever number is non–comparable with ∞ and, consequently, whatever number is "equivalent".

I think that this way of reasoning is a mere sophism. It is comparable with Zenone's paradox of Achilles and the tortoise. As well as it is impossible to explain motion with elementary logic (as already Aristotle remarked), it is impossible to explain the progress of science with elementary logic. None the less, progress does

[26] Cf. Fleck, *Crisis in Science*, in Cohen and Schnelle, *Cognition...*, op. cit.: 155.

exist. It is in front of our eyes as well as motion of bodies. In order to explain the latter we had to develop a very sophisticated dynamics (based on mathematical tools unknown by the Greeks). *I assume that present epistemology does not explain scientific progress in a fully satisfactory way, because it is still in a rudimentary stage.*

In more specific terms (by being one of the grandsons mentioned by Fleck) I feel entitled to express my opinion about the progress of medicine. To me, the science of 1940 seems closer to the objective picture of reality than the science of 1840. I can say more: 1940 science seems to be much closer to the truth than 1935 science, that is, that possessed by Fleck in the year of publication of his masterpiece. A few years after the appearing of his book, in fact, we discovered that: a) the antibodies–antigen (Ab–Ag) reaction is not necessarily specific (that is, a serum containing an antitreponema Ab does not react only with treponema); b) Ag does not have to be necessarily a protein; c) lipids can be the support of immunological specificity (in the 1930s, the few lipids whose structure had been established were lecithin, cholesterol or sphingomyelin and they were found in most of the tissue analyzed; consequently, it was hard to suspect that lipids are immunogenic); d) the factor responsible for the reaction with serum from syphilitic patients was a phospholipid (isolated in 1942 by Pangborn and called cardiolipin); e) cardiolipin is a constituent of treponema, but it is also present on various tissue (that is why the reaction was possible on non–infected liver homogenate); f) it is possible to circumvent this anticomplementary interference by combining cardiolipin with lecithin. In sum, some years after the appearing of Fleck's book, immunologists discovered the chemical structure of the antigen involved in the Wassermann reaction. Moreover, Fleming discovered penicillin, which eradicates completely the disease. Hence, Fleck's skepticism about the progress of bacteriology and immunology can be also understood in the light of the knowledge of his time.

Of course, we cannot assert that these discoveries are definitive (we can grasp *truth*, not *certainty*), but similarly we cannot assert that they are *of necessity* non–definitive. As Bunge convincingly remarks "[p]hilosophers have taken care of epistemological relativism or skepticism with the help of purely logical arguments or by listing some of the last findings of science, such as the heliocentric theory of the planetary system, the circulation of the blood, the existence of electromagnetic fields, atoms, and genes, and the evolution of biospecies. These and most of the truth of logic and mathematics are surely some of the many full (not just partial) and eternal truths established since the beginning of the modern era – *pace* such distinguished skeptics as Hume, Engels, and Popper"[27]. Till when these theories: remain non–refuted (in spite of the fact that scientists are free to produce attempts at refutation); provide precise predictions; are proved to be logically consistent; constitute the basis for effective technological applications, we are allowed to consider them as *true*.

---

[27] M. Bunge, *A Critical Examination...*, op. cit.: 50.

Without a doubt, treponema pallidum, cardiolipin, antigen, sphingomyelin, lecithin, cholesterol, and penicillin are *socially constructed concepts*. Natives of, say, New Guinea could not conceive of the problem of syphilis in these terms. They are *social constructs* as well as the previous theories: a) syphilis is caused "ex conjunctione Saturni et Iovis in tertia scorpionis facie in 23 gradu transacta 1484 tumque aliarum stellarum fixarum configuratione tunc temporis simul concorrentium..." (brief, astrological explanation); b) syphilis is caused by the will of God, who wants to punish sinners (brief, theological explanation). None the less, these concepts and theories appear to us as non–equivalent constructs.

I am sure that even the most radical relativist could accept to have sexual intercourse when there is a "conjunctione Saturni et Iovis in tertia scorpionis", but he/she would never allow a physician to inject a suitable quantity of treponema pallidum in his/her blood. This means that we have good reasons to conclude that the theory of germs disease is socially constructed better than astrology.